From Cleanup
To Stewardship

Preparation for Entombment. Before the Hanford "C" reactor core is entombed within its shielding walls, related structures are first decontaminated and dismantled. Contaminated soils and materials from the area have been disposed of in the Environmental Restoration Disposal Facility (below). Once entombed, the reactor core will require monitoring and maintenance for up to 75 years until a decision is made on its final disposition. *C Reactor, Hanford Site, Washington, July 1998.*

The Environmental Restoration Disposal Facility. This engineered unit receives waste generated by the Hanford site cleanup. Its bottom is lined with multi-layer high-density polyethylene. When full, the facility will be covered with a RCRA-compliant multi–layer cap, a vegetative cover, and a five-meter intrusion barrier made of basalt, concrete, boulders, silty soil, and plastic. Between its opening in 1996 and 1999, the site has taken in more than 1.6 million tons of contaminated soils and material. It is expected to close in 2046. Access to waste disposal areas and buffer zones will be restricted for as long as necessary to protect human health and the environment. *Environmental Restoration Disposal Facility, Hanford Site, Washington, July 1998.*

DOE/EM-0466

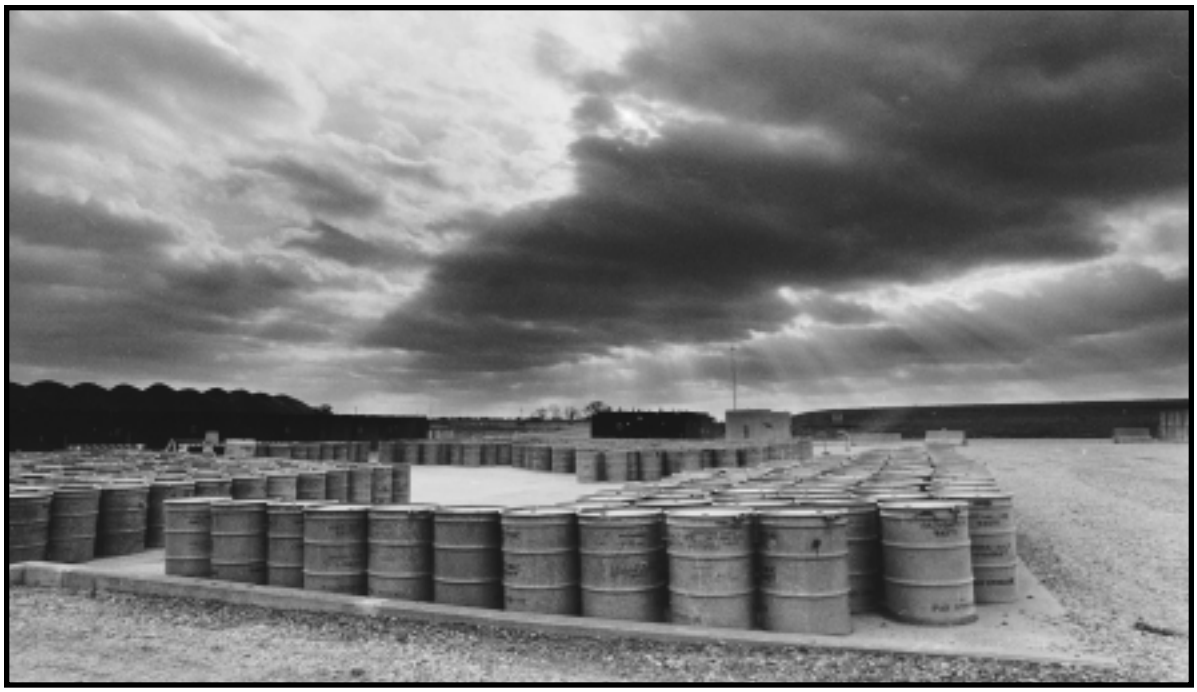
From Cleanup To Stewardship

a Companion Report to *Accelerating Cleanup: Paths to Closure*

and

Background Information
to Support the Scoping Process
Required for the 1998 PEIS Settlement Study

U.S. Department of Energy
Office of Environmental Management
October 1999



Transuranic Waste Storage Pads. Drums containing transuranic waste sit on a concrete pad in temporary storage. This waste is contaminated with uranium-233 and plutonium. In 1999, the Department began disposing of transuranic waste in the Waste Isolation Pilot Plant near Carlsbad, New Mexico. *Transuranic Waste Storage Pads, E Area Burial Grounds, Savannah River Site, South Carolina, January 1994.*

Table of Contents

Appendices

Sedan Crater. This crater is the site of a 110-kiloton thermonuclear explosion at the Nevada Test Site in 1962. The crater is 600 feet deep and 1,200 feet wide. Because of the widely dispersed plutonium and other radionuclides that resulted from this explosion, this test area and others will require long-term institutional controls to prevent inadvertent exposure to residual contamination. *Area 10, Nevada Test Site, Nevada, October 1984.*

Low-Level Waste Burial. The Idaho National Engineering and Environmental Laboratory disposes of low-level waste in this pit at the Radioactive Waste Management Complex Subsurface Disposal Area. The laboratory has 4,700 cubic meters of low-level waste in inventory and is projected to generate an additional 115,000 cubic meters in the next 35 years. New waste will come from facility decommissioning and dismantlement, treating and characterizing other waste streams, and ongoing processes. *Radioactive Waste Management Complex, Idaho National Engineering and Environmental Laboratory, Idaho, March 1994.*

Preface

Beginning with the Manhattan Project during World War II, the Federal Government has carried out extensive nuclear weapons research and development, production, and testing activities. Since the Cold War began, significant institutional, scientific, and legal changes occurred: massive industrial facilities were constructed, operated, and in many cases, shut down; scientific research revealed much about how ionizing radiation may affect human health; major environmental laws have been enacted; and the missions of the Department of Energy (DOE) and its predecessors changed significantly as a consequence of national and world events.

Perhaps the biggest changes in the nation's nuclear weapons enterprise are now upon us. The Cold War ended nearly a decade ago, and the Department has undertaken a massive program to address the environmental consequences of nuclear weapons production, while using a smaller complex of facilities to maintain the nuclear weapons stockpile.

Despite these dramatic changes, one thing has remained constant — the Federal Government's obligation to protect human health and the environment. The Atomic Energy Act of 1954 provides for protecting health and minimizing danger to life and property. Since then, a number of environmental laws have imposed additional requirements on DOE's facilities, operations, and activities. The need to address environmental, safety, and health issues will remain as we enter a new millennium.

Eighty-third Congress of the United States of America

Begun and held at the City of Washington on Wednesday, the sixth day of January, One thousand nine hundred and fifty-four

An Act

To amend the Atomic Energy Act of 1946, as amended, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Atomic Energy Act of 1946, as amended, is amended to read as follows:

"ATOMIC ENERGY ACT OF 1954

"Sec.2.Findings.–The Congress of the United States hereby makes the following findings concerning the development, use, and control of atomic energy:...
"b. In permitting the property of the United States to be used by others, such use must be regulated in the national interests and in order to provide for the common defense and security and to protect the health and safety of the public...
"d. The processing and utilization of source, byproduct, and special nuclear material must be regulated in the national interest and in order to provide for the common defense and security and to protect the health and safety of the public...
"Sec.3.Purpose.–It is the purpose of this Act to effectuate the policies set forth above by providing for– ...
"d. a program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public...

"Sec.161.General Provisions.– In the performance of its functions the Commission is authorized to– ...
"b. establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property;...
"i. prescribe such regulations or orders as it may deem necessary...
"(3) to govern any activity authorized pursuant to this Act, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property;...

Approved:
Dwight D. Eisenhower.
30 Aug. 1954
Washington, D.C., 1600 Penna. Avenue
9.44 A.M.

Excerpts from the Atomic Energy Act of 1954. This Act governs the management of radioactive materials by DOE. The Act was signed into law by President Dwight D. Eisenhower on August 30, 1954 (photo page A-1).

Introduction

During the last decade, the Department of Energy (DOE) has made significant progress in its environmental cleanup program (see Exhibit 1), resulting in substantially lower risks and lower annual costs for maintaining safe conditions. This experience in planning and completing cleanup has made one fact clear: complete restoration to levels acceptable for unrestricted use cannot be accomplished at many sites. Consequently, long-term stewardship will be needed at these sites to ensure that the selected remedies will remain protective for future generations. According to this background document, long-term stewardship includes all activities required to protect human health and the environment from hazards remaining at DOE sites after cleanup is complete.

DOE is required to conduct stewardship activities under existing requirements (see Appendix B), and many DOE organizations have been conducting stewardship activities over the years as part of their ongoing missions. Scientists and engineers have long understood that much of the waste and other materials managed by DOE (i.e., radionuclides and metals) cannot be broken down into non-hazardous materials. These materials must be managed by treatment, isolation, and monitoring.

Exhibit 1: Cleanup Progress Since 1989

- **The Department has completed remedial work (i.e., "cleanup") at almost half of its sites.**
- **Significant progress has been made in constructing and operating waste treatment and disposal facilities.**
- **Hundreds of kilograms of dangerous nuclear materials have been stabilized.**
- **Approximately 450 facilities have been decommissioned through 1998.**
- **Dozens of new technologies, developed and implemented at DOE sites, have enabled the Department to reduce risks and "mortgage" costs and remedy previously intractable contamination.**

Existing Requirements for Long-Term Stewardship

Existing laws, regulations, and DOE policies and directives provide broad requirements for DOE to conduct monitoring, reporting, record keeping, and long-term surveillance and maintenance for waste management facilities, soil and buried waste, engineered waste disposal units, facilities, surface water, and groundwater (see Appendix B).

Long-term stewardship activities are being conducted by a variety of DOE organizations. For many DOE sites and organizations, stewardship activities represent only a minor part of their principal mission, although long-term stewardship is the only mission at several sites.

Although statutory and regulatory requirements provide a general foundation for long-term stewardship, it is not certain whether existing requirements encompass all of the activities that may be involved in long-term stewardship, nor do they ensure the development of effective implementation strategies.

For example, the preferred remedy for many radionuclide contaminated soils will be to excavate the soil and place it in an engineered disposal cell (e.g., a landfill or an above-ground vault). While this results in a safer overall site end state, the radionuclides will remain at the site and pose a known hazard for years into the future while the natural decaying process takes place. The disposal cell, therefore, will need long-term monitoring, maintenance, and controls to ensure the remedy remains protective of human health and the environment in the future.

The realization that long-term stewardship ultimately will be a primary mission at most DOE sites grew out of analytical efforts to develop a clearer "path forward," and to improve the financial and managerial control of the Department's Environmental Management (EM) program. These analyses, published in the *Baseline Environmental Management Reports* (DOE 1995b, 1996c) and *Accelerating Cleanup: Paths to Closure* Report (DOE 1998a), have helped the Department estimate the long-term costs and schedule of the cleanup program well into the 21st Century.

Why Address Stewardship Now?

- **To provide for smooth transition from cleanup to long-term stewardship through technical, financial, and managerial planning**
- **Emphasize that the "cleanup" goal in many cases is to reduce and control, not eliminate, risk and cost**
- **Ensure that Congress, regulators, and other stakeholders have a clear understanding of what the cleanup mission will "produce" and clarify that there is an attainable end point**
- **Set realistic expectations and show interim successes and results**
- **Identify technology research and development needs**
- **Assure regulators and the public that DOE will not walk away from its enduring obligations.**

The results of these analyses have helped put a price on the environmental consequences of the Cold War, and they have revealed how to reduce that price through smarter ways of doing business, especially by accelerating cleanup. Four major findings of these analyses were:

- The initial projected cost was too high and the timetable too long for Congress to be expected to provide continuing support of the program.[1] Significant changes were therefore required to improve efficiency and expedite the cleanup.
- Substantial costs were projected for maintaining infrastructure and safe conditions during cleanup operations, rather than directly paying for cleanup. Therefore, accelerating cleanup will reduce costs.
- Many of the Department's cleanup plans assume that waste and residual contamination will be stabilized, but cannot be removed entirely. These plans have been and will continue to be approved by regulators and made in consultation with stakeholders.
- Many of the DOE sites that have not completed cleanup are just beginning to define the full scope and cost of long-term stewardship activities.

Upon publication of the second *Baseline* report in 1996, the Department established a goal of completing cleanup at as many sites as possible by the year 2006. To accomplish this goal, the Department increased its efforts to improve efficiency through greater integration among site cleanup programs, and related initiatives. The Department reorganized the budget structure for the EM program into more than 350 "projects" to focus attention on discrete sets of tasks with clear end points. The Department also established a new account structure with three general budget categories:

- "Site Closure" – sites for which EM has established a goal of completing cleanup by the end of FY 2006. After cleanup is completed at these sites, no further Departmental mission is envisioned, except for limited long-term surveillance and maintenance, and the sites will be available for some alternative use.
- "Site/Project Completion" – projects that will be completed by 2006 at EM sites where overall site cleanup will not be fully accomplished by 2006; and entire sites where cleanup will be completed by 2006 (except for long-term stewardship activities), and where there will be a continuing federal workforce at the site to carry out enduring missions.
- "Post 2006 Completion" – projects that are expected to require work beyond FY 2006.

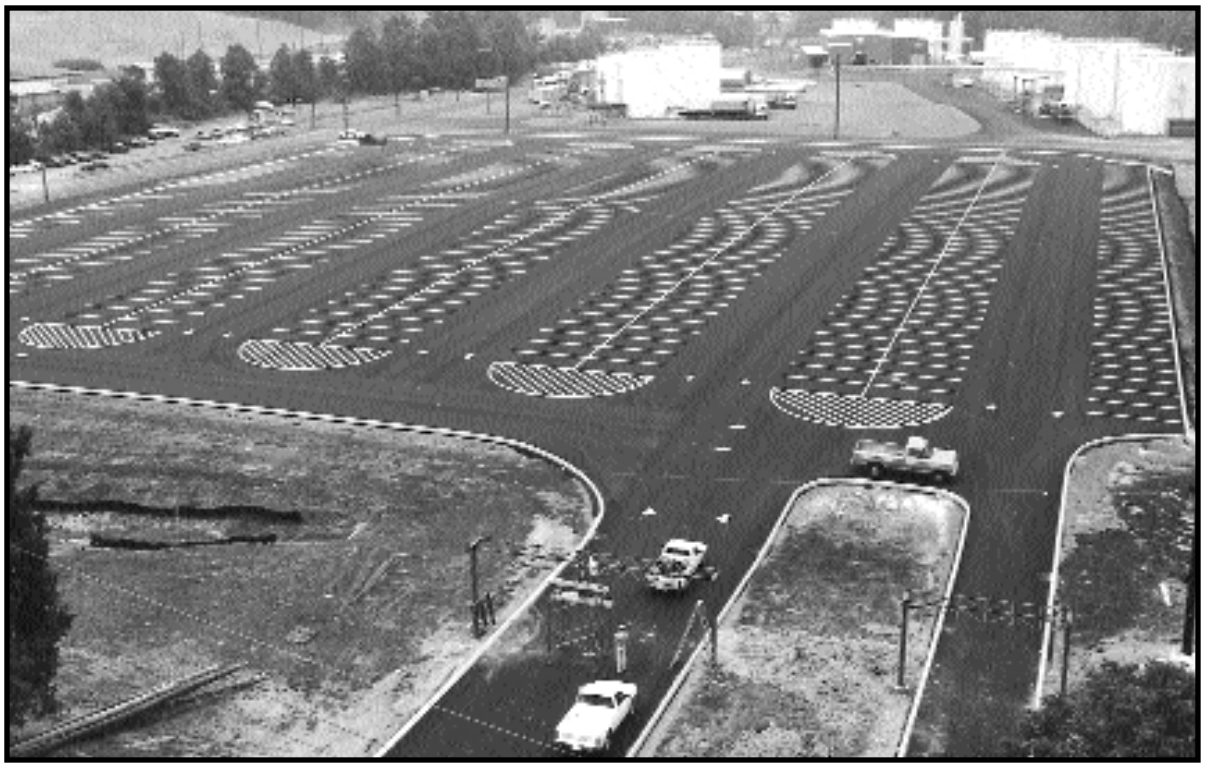
This improved cleanup and closure effort was described initially in a draft report in February 1998, *Accelerating Cleanup: Paths to Closure,* and in a revised report issued in June 1998 (DOE 1998a). Among other things, this report described the projected end state for each site once cleanup has been completed.

1. The *Baseline Environmental Management Reports* estimated that cleanup costs would be approximately $230 billion, whereas the most recent estimate (*Paths to Closure*) has been $147 billion. The differences reflect efficiency improvements as well as smaller scope (i.e., newly generated waste is not included in the $147 billion estimate) [see DOE 1998a].

Submarine Hull Disposal Trench. When a nuclear-powered submarine is decommissioned, the spent nuclear fuel is removed from the submarine's reactors and the section of the submarine containing the reactor is disposed of in a trench. The radioactively-contaminated hull sections with the defueled reactors inside are transported by barge to the Hanford Site, where they are placed in a large trench for burial. The disposal trench will require long-term monitoring and maintenance to ensure that hazardous materials remain inside the hulls. *Trench 94, Hanford Site, Washington, July 1998.*

Submarine Hulls Up Close. Use of the thick steel submarine hull as a disposal container provides extra isolation between the environment and the low-level waste and hazardous lead that remain after the spent nuclear fuel has been removed. *Trench 94, Hanford Site, Washington, July 1998.*

Before. These four ponds received wastewater until 1985 from operations at the Y-12 Plant where uranium isotopes were separated using an electromagnetic process. *Oak Ridge Reservation, Tennessee. Photo circa 1985. Source: U.S. Department of Energy.*



After. From 1985 until 1990, liquids in the above four waste ponds were treated to remove contaminants, the ponds were then drained and capped with asphalt, and the capped area used as a parking lot. The asphalt cap will require long-term monitoring and maintenance to ensure its integrity and prevent migration of the residual contamination beneath it. *Oak Ridge Reservation, Tennessee. Photo circa 1990. Source: U.S. Department of Energy.*

Purpose of Report

This report has been prepared to fulfill two commitments made by the Department. First, *Paths to Closure* indicated that further discussion of end states and long-term stewardship would be presented in a companion report (see p. 6-3 in DOE 1998a). Secretary of Energy Bill Richardson formalized this commitment in his 1999 Performance Agreement with the President.

Second, the Department settled a lawsuit in December 1998 that requires DOE, among other things, to prepare a study on long-term stewardship (Joint Stipulation 1998). Although the study will not be conducted under the National Environmental Policy Act (NEPA), the study is required to follow certain of the procedures of the Council on Environmental Quality for conducting a scoping process under NEPA, as well as the Department's NEPA procedures regarding public comment. Specifically, the Settlement Agreement provides

> DOE [will] prepare a study on its long-term stewardship activities. By 'long-term stewardship,' DOE refers to the physical controls, institutions, information and other mechanisms needed to ensure protection of people and the environment at sites where DOE has completed or plans to complete 'cleanup' (e.g., landfill closures, remedial actions, removal actions, and facility stabilization). This concept of long-term stewardship includes, *inter alia*, land use controls, monitoring, maintenance, and information management.

See Appendix A for the complete language of the relevant section of the agreement.

For the purposes of this analysis, the definition of long-term stewardship also includes sites for which DOE will have long-term responsibility, even though DOE was not responsible for actual cleanup at these sites (e.g., certain uranium mill tailing sites). DOE will determine the breadth of the long-term stewardship study considering public scoping comments pursuant to the terms of the Settlement Agreement.[2] This report provides background information for that scoping process. It is intended to provide a basis for more informed discussions among various DOE offices, regulators, and affected communities on stewardship needs and the potential links between existing and future cleanup decisions, risks, costs, technologies,

How Does This Report Relate to the *Paths to Closure* Process and the Study Required by the Settlement Agreement?

The site-specific data used to develop *From Cleanup to Stewardship* are based on information submitted by the sites in support of the June 1998 *Paths to Closure* report. Significant public involvement is being conducted at both the site and national levels for this ongoing process. Therefore, issues regarding site-specific data are addressed through the *Paths to Closure* process. Information on that process can be obtained at *www.em.doe.gov/closure* or from the Environmental Management Information Center (1-800-736-3282). No additional data were collected for this report.

This background report provides a national summary of the nature and extent of DOE's current and anticipated long-term stewardship needs. It also examines some of the issues, challenges, and barriers associated with the transition from cleanup to long-term stewardship.

A follow-on long-term stewardship study, pursuant to the terms of the Settlement Agreement, will examine these issues, challenges, and barriers in greater detail and will begin to identify potential paths forward for the Department. However, the study process will not interfere with site-specific activities for developing cleanup and long-term stewardship strategies. Because long-term stewardship is a relatively new concept, there are few precedents upon which to rely. Therefore, the Department is actively seeking broad public input to the draft study process. Information on how to become involved in the draft study process can be obtained from *www.em.doe.gov/lts* or the Environmental Management Information Center at 1-800-736-3282.

2. According to the Settlement Agreement, DOE will follow the procedures set forth in the regulations of the President's Council on Environmental Quality (CEQ) for public scoping, 40 CFR 1507.7(a)(1)-(2), and the procedures set forth in DOE's NEPA regulations for public review of environmental impact statements, 10 CFR 1021.313, except that (a) DOE will not transmit the study, in draft form, to EPA, and DOE (not EPA) will publish a Notice of Availability in the Federal Register as set forth in 10 CFR 1021.313 (a), and (b) DOE will not include any Statement of Findings as set forth in 10 CFR 1021.313 (c).

future land use, and the level of effort required to conduct stewardship activities.

Organization of the Report

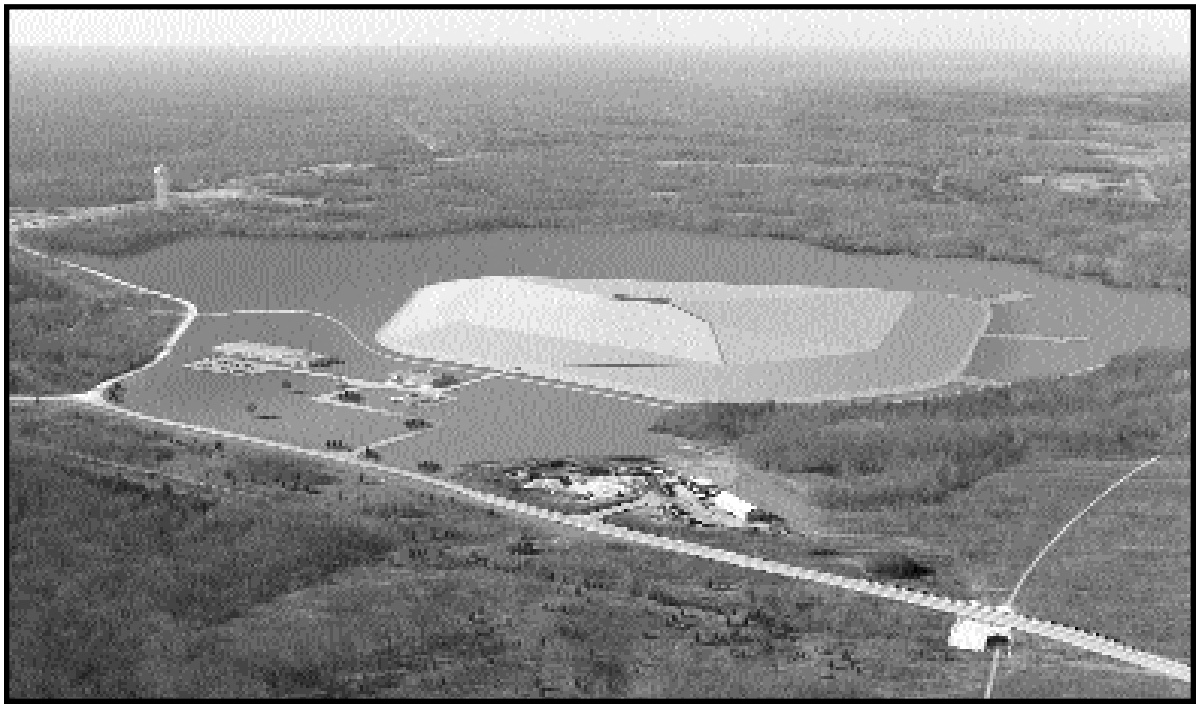
In three chapters this report will address the following:

- **The Nature of Long-Term Stewardship at DOE Sites (Chapter 1)**, which describes the scope and breadth of long-term stewardship activities and why they will be required.
- **Anticipated Long-Term Stewardship at DOE Sites (Chapter 2)**, which summarizes what is known so far about end states, the number and location of sites that will likely require stewardship, the type of stewardship required, and which sites are currently carrying out stewardship activities.
- **Planning for Long-Term Stewardship (Chapter 3)**, which outlines several issues the Department has initially identified that need to be addressed to ensure a successful transition from cleanup to long-term stewardship, and that may be appropriate to consider in the long-term stewardship study required by the Settlement Agreement.

The Weldon Spring Site Before, During and After Cleanup (Pages 6 and 7)

Before: The Weldon Spring Uranium Feed Materials Plant. This facility processed uranium ore concentrates and small amounts of thorium for use in nuclear weapons from 1958 to 1966. Between 1963 and 1969, the Atomic Energy Commission disposed of uranium residues and small amounts of thorium residues in the nearby Weldon Spring Quarry. Environmental remediation at this site began in 1985. *Weldon Spring Uranium Feed Materials Plant, near St. Louis, Missouri. Photo circa 1965. Source: U.S. Department of Energy - Weldon Spring Site Remedial Action Project.*

During: Weldon Spring Site Remedial Action Project. Remediation began at Weldon Spring in 1985 and involved dismantling the chemical plant buildings, excavating contaminated soils, and disposing of radioactive and chemically- contaminated soil and debris. *Weldon Spring Site Remedial Action Project, near St. Louis, Missouri, March 1996.*



Artist's Conception: Weldon Spring After Cleanup. This computer-generated image illustrates what the Weldon Spring disposal cell will look like after site remediation has been completed in 2002. Encompassing 42 acres, the cell will be 65 feet high and will contain approximately 1.4 million cubic yards of radioactively contaminated materials. After the cell has been completed, DOE will remain responsible for its long-term surveillance and maintenance. *Weldon Spring Site Remedial Action Project graphic. July 1999. Source: U.S. Department of Energy - Weldon Spring Site Remedial Action Project.*